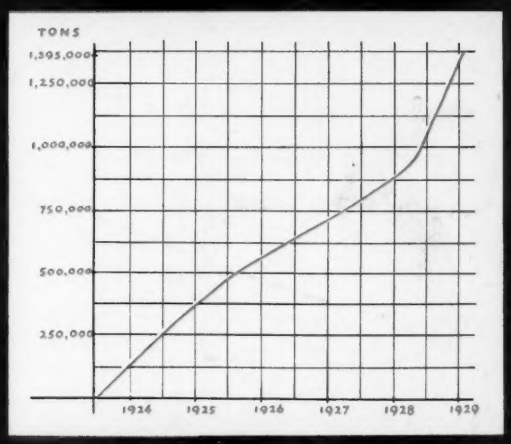
WIRE
& WIRE PRODUCTS



THE MOTOBLOC SALES CURVE *Goes steadily upward*

The graph reproduced above indicates very clearly the remarkable success of the Vaughn Motobloc since it was first introduced to the wire industry in September 1924.

Each year has seen a rapidly increasing number of Motoblocs in use—with the result that today—that is, January 1, 1930,—there is an estimated full time yearly capacity of Motoblocs in service of 1,395,000 tons. These figures include of course all Motoblocs in service—regardless of the material being drawn.

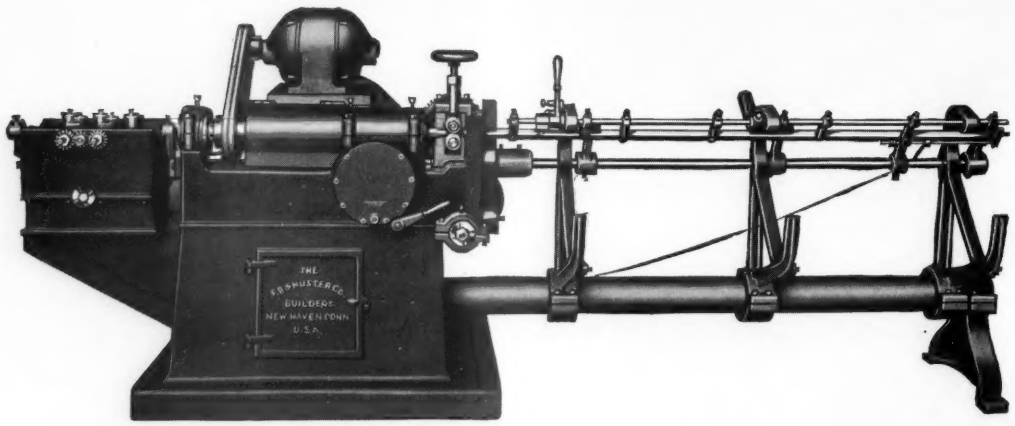
The reason? . . . . . Performance . . . . . .

The Vaughn Machinery Company
CUYAHOGA FALLS, OHIO
Export Office
420 LEXINGTON AVE., NEW YORK

January 1930

SHUSTER

Automatic Wire Straightening and Cutting Machinery



If you wish to **increase your production** on hard wire, the Machine shown this month will do the work. It is equipped with a five roll straightening device, which rough straightens the wire before it passes into the rotary head for finishing. The rotary head is of steel, and mounted in Timken Roller Bearings; a high grade machine in every way.

Let us tell you more about it.

THE F. B. SHUSTER COMPANY

NEW HAVEN, CONN.

STRAIGHTENER SPECIALISTS SINCE 1866

WIRE & WIRE PRODUCTS, Vol. 5, No. 1, January, 1930. Publication office, 49 E. Washington Ave., Washington, N. J. Executive office, 551 Fifth Avenue, New York, N. Y. Published by the Quinn-Brown Publishing Corp., Richard E. Brown, President; R. S. Spengel, Secretary and Treasurer. Subscription price: U. S. and Canada, $5.00 per year, 50 cents per copy; Foreign, $7.50 per year. Entered as second class mail at the Post Office at Washington, N. J., under the Acts of March, 1879, and copyright, 1929, by Quinn-Brown Publishing Corporation.

Wire Drawing and the Cold Working of Steel

By Alastair T. Adam, A. R. T. C.

(Associate, Royal Technical College, Glasgow)

The only book of recent years dealing exclusively with the problems of cold working and wire drawing. Written by a leader in the field. 212 pages. Cloth bound boards, 7½x10 inches. Profusely illustrated from photographs. Indexed. Price: $13.00 a copy, carriage prepaid.

Contents

I. Introductory
II. Wire Drawing
III. Wire Drawing: The Cold Working Operation
IV. Cold Rolling and Other Cold Working Processes
V. Heat Treatment
VI Effect of Cold Work on the Physical Properties of Metals
VII. Effect of Cold Work on the Physical Properties of Metals (cont.)
VIII. The Effect of Heat Treatment After Cold Work
IX. Theories of Plastic Flow in Cold Worked Metals
X. The Pathological Aspect of Cold Working Operations
XI. The Application of Cold Work to Non-Ferrous Metals and Alloy Steels

British Wire Drawing and Wire Working Machinery

By H. Dunell, A. C. G. I., A. M. I. Mech. E., B. E.

(Editorial Staff, "The Engineer")

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III. Dies
IV. Wire Drawing Blocks
V. Continuous Wire Drawing Machines
VI. Straightening and Cutting off Machines
VII. Wire Factories
VIII. Wire Netting Machinery
IX. Wire Factories
X. Wire Weaving Looms
XI. Electric Cable Making
XII. High Speed Stranding Machines
XIII. Barbed Wire Machines
XIV. Nail and Rivet Making Machines
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For handling all kinds of ferrous and non-ferrous wire. The wire does not stop while being cut off, thus producing an absolutely uniform diameter rod from end to end, free from markings or bulges. It is not necessary to stop the machine when starting or finishing a coil of wire, due to our specially designed straightening flyer. The rods are cut to accurate length at a speed of 100 feet per minute. Each size machine will handle a wide range of wire diameters. Rotary flyer made of .50 carbon machinery steel. All fast running parts mounted in heavy duty ball bearings.

Write for full particulars

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THOMASTON, CONN.

THE New Year promises not alone much activity in the new metals, as referred to briefly in an earlier issue, but somewhat as a result of the uses of these new materials, new machines also. Thus, to refer to a single one of them, tungsten carbide, now being widely adopted for wire-drawing dies, is bringing about new lathes. These have higher power, which means newer and larger electric motor. They have also a different gear box since the new tungsten tool points permit much higher surface speed of the metal being cut and the lathes must be geared up to take advantage of this. To run faster and at the same time utilize higher power, they must be stronger and heavier. More power, larger motors, more and faster speeds, heavier and stronger machines, these total a good many major differences.

In the wire field, there promises to be many similar developments. The new tungsten carbide dies may not necessitate higher powered breakdowns and other blocks, but in time, they will have a considerable influence on the design of all machines for drawing wire through hard-metal dies. In the manufacture of filaments for radio tubes, a new metal called konel has been developed that is said to be a satisfactory substitute for the platinum used hitherto. This is claimed to be stronger and tougher than other metals at high temperatures, having the peculiar quality of holding its strength and toughness as the temperature rises which other metals do not do, losing both as the heat increases. Because of this strength and toughness this must be drawn in a different manner, and in time, its use will produce different machines for drawing it.

The early opening of a very large wire-drawing plant undoubtedly will bring a number of departures from conventional machines and methods.

WIRE & WIRE PRODUCTS

A monthly publication devoted to wire drawing and wire forming

Vol. 5 January 1930 No. 1

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Editor
Morris A. Hall

Associate Editors
L. D. Granger George A. Paff
R. E. Brown, Business Manager

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We make dies exclusively

Un-Widia Alloy Dies are the result of the collaboration of the world's best known makers of special alloys, Fried Krupp Co., and America's largest wire and tube die manufacturers, the Union Wire Die Corporation, who have the exclusive right to sell Widia metal, for drawing purposes, in the United States, Canada, Mexico and France.

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UNITED STATES, CANADA, MEXICO and FRANCE
BY

UNION WIRE DIE CORPORATION

NEW YORK

WIRE & WIRE PRODUCTS

Vol. 5 JANUARY, 1930 No. 1

How Airplane Tie Rods and Tie Rod Wires Are Made

Steps in Process Between Raw Wire and Finished Streamlined Airplane Struts of Varying Cross Section

By C. B. Phillips

Vice President, Surface Combustion Co.

ONE of the supreme tests of steel wire or rods is their use in airplanes for, literally, when flying, a man's life "hangs on a thread" albeit a steel one. Nor is strength the only requisite, for these wires must be so shaped as to afford the least resistance to the air when in use.

In the accomplishment of these two ends, special machines are employed to give the wire an oval form in cross-section and specially-developed heat treatments are used to give it strength. Naturally the chemical analysis of the steel and the drawing practice in the mill are vital factors, but the heat treatments are based on these conditions and supplemental thereto.

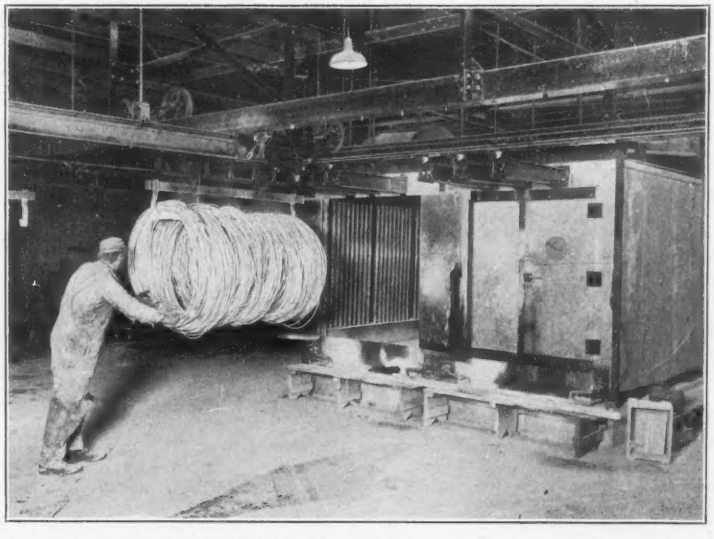
The world's largest manufacturer of airplane tie rods and tie rod wire is the Macwhyte Co., Kenosha, Wisc. Macwhyte sells to practically every aircraft manufacturer in America and one firm alone takes 20 sets weekly.

This, however, is only one of the specialties made by the Company, for its primary product is wire rope and cable. It makes wire rope in sizes ranging from 1-16 to 4 in. in diameter. Other specialties made by this company include Keystone shaped wire for lock washers, high grade spring wire, etc., etc.

Making Airplane Wires Is Complex Process

The manufacture of tie rods and tie rod wire for heavier than air machines is complex and exacting. In the first place, raw material is purchased according to definite specifications and every heat from every shipment that comes in is analyzed to check its chemical analysis, is subjected to microscopic examination for imperfections and its grain structure is checked by microphotographs.

When the product is finished, it is given tensile, bending and torsional tests—that is, one of every 50 wires is picked at random for these tests.



Automatically-controlled Gas-fired Baking Ovens from which air is exhausted at a definite rate. Wire is carried through on a trolley.

The streamline tie rod, now standard throughout the aircraft world, was first developed at Brunton's, Musselburgh, Scotland. During the war, R. B. Whyte made a trip to this plant, studied the processes, and brought back the first rolling mills ever used in America for this type of work. Fifteen days after these mills had been landed in this country,

FIRTHALOY DIES

FOR QUALITY.. *and* QUANTITY IN WIRE DRAWING

QUANTITY and quality—every manufacturer will need both and at as low a production cost as possible, to show a profit during 1930.

FIRTHALOY* Tungsten Carbide Dies for wire drawing, extrusion and other drawing purposes are showing the way to lower production costs to many manufacturers.

The patented profile of Master Firthaloy Dies was evolved after three years of experimentation. This design eliminates "shouldering" and facilitates proper lubrication, RESULTING IN A CONSIDERABLE SAVING IN POWER. The nibs, approaching the diamond in hardness, are accurately fitted into heat treated stainless steel casings, insuring extraordinarily long life for the die.

The Master Wire Die Corporation makes these dies entirely by mechanical means with special equipment installed at a cost of over $200,000. This mechanical production eliminates the uncertainty of the personal element and turns out dies of extreme accuracy, making possible the exact DUPLICATION of a die.

Master Firthaloy Dies are furnished in all the standard sizes shown in price lists furnished on application.

**A product of the Firth-Sterling Steel Company, formerly known as "Dimondite".*

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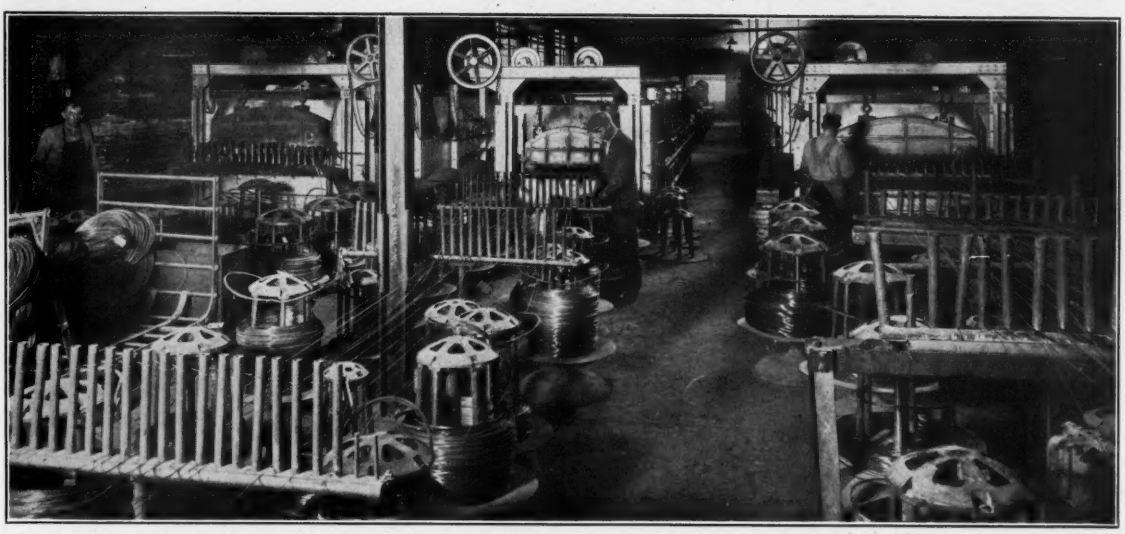


In-going end of Three Gas-fired Patenting Furnaces at the Macwhyte Co.'s plant at Kenosha, Wisc.

How Airplane Tie Rods

(*Continued from page 5*)

they had been set up and were producing wire.

This streamline wire or tie rod adds 10% to the speed of the plane with the same engine consumption of oil and gasoline, due to the reduction in air resistance. On the average small commercial plane, this saving in gasoline amounts to approximately $1.00 an hour for every 100 miles of travel.

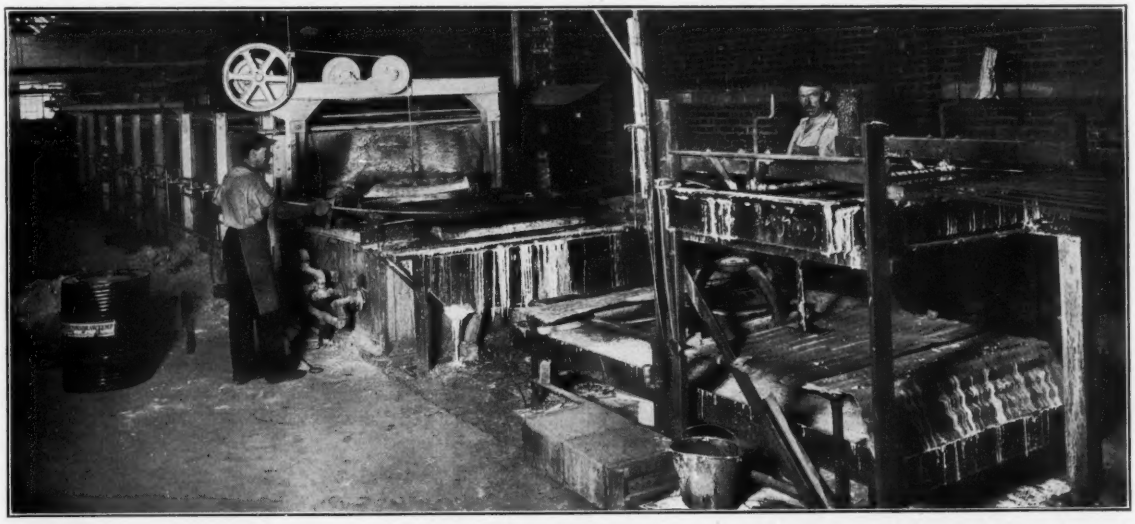
The Kenosha plant of Macwhyte Co. contains 250,000 sq. ft. of floor area and is divided into the following departments: patenting furnace room, pickling, wire drawing, wire rope mill, aircraft department, machine shop, warehouse and office.

Pickling Is the First Operation

Pickling or process cleaning is the first operation and consists of pickling, washing and lime coating the raw material, after which it is baked. This department is divided into two parts, one for each treatment. The first contains six pickling vats and one for lime, while the second has ten pickling vats, two lime tanks and one for copper sulphate, the copper sulphate coating being used on all wire going to finish size. Both are served with overhead traveling cranes, jib cranes, etc.

The wire to be put through these processes comes in coils which are opened up, lifted into the vats by cranes and agitated by moving up and down. They are then moved along to the washing floor where workmen wash them with water and hose, immersed in the copper sulphate solution and are then put into the lime. The pickle is in sulphuric acid, which runs from 3 to 5% by volume, is carried at 140° F. and the lime bath at 180° F. The copper sulphate solution is cold.

The lime coated coils are put



Out-going end of the Patenting Furnace showing tempering kettle, kept at constant heat by automatically-controlled gas burners.

onto steel buggies which are pushed into an oven for baking. The oven contains three compartments, each being 30 ft. long, 18 feet wide and 4 ft. high. Each compartment will hold 24 buggies, there being three tracks with room for eight buggies on each. This oven is brick, suitably stayed, and has two flues running under all of the compartments, looping back and forth to procure the maximum heating surface.

Gas burners with the Surface Combustion Co. system of firing are used and the wire is subjected to a temperature of about 300° F. for some 6 hours. This temperature is maintained with the aid of a recording thermometer. This heating is to drive off any hydrogen that may have been absorbed by the steel as same is liberated in the chemical action in the pickle.

The hydrogen makes the steel brittle but is readily driven off by heat. Lime is used to neutralize any free acid that may adhere to the surface, and also acts as a lubricant during cold drawing. Powdered soap, lime and copper coat are all used as lubricants with a definite quantity of each.

Details of the Wire Drawing

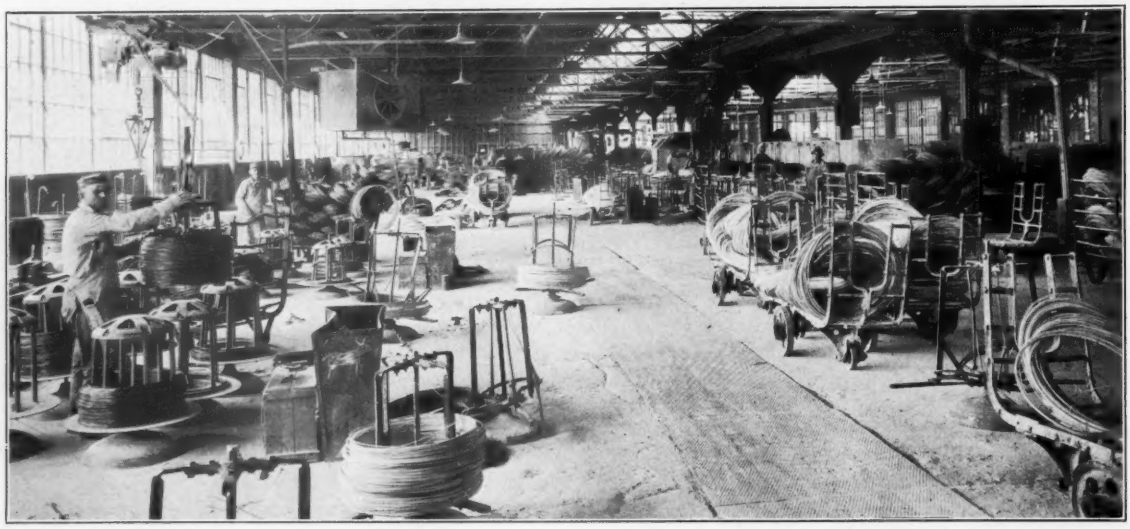
The drawing is accomplished in a long building with groups of blocks carrying the coils and the wire running through dies. The block groups range from 8 to 22 in., the large block being in the smaller groups. Each group is driven by a separate motor, through silent chain drives. These blocks are run at the highest speed commensurate with the maximum over all efficiency and quality of product. These speeds through the dies range from 180 to 220 ft. per minute, according to the size of the wire.

Aircraft wire is drawn in this department to round sizes and is then sent to the aircraft department where it is straightened and cut to length. The center sections are then given an oval shape in rolling mills after which the ends are threaded with right and left hand threads and the terminals assembled. The terminals consist of yokes for assembly to the plates where the struts join the wings and also to the plates on the fuselage. The right and left threads convert the rod into a turnbuckle for adjusting tension and lock nuts prevent them from loosening.

Wire Not of Uniform Cross Section

The round aircraft wire is made with a reduced center section between the threaded ends. In fact the center section is about half the weight, inch for inch, as the threaded section but has twice the strength. Round strands were formerly used for internal bracing of fuselage and wings but they are fast becoming obsolete and the round rods are taking their place.

The raw material is patented as is the wire at different stages in the drawing process. This patenting is a process of normalizing to relieve the strains set up by cold-working and also to produce a grain structure that will provide the greatest strength and toughness. The number of these heat treatments is influenced by the amount of cold-working and varies from one to three, including that given the raw material.



Wire-drawing frames at Macwhyte's, showing hoists for handling wire drawing from blocks to reels.

The patenting room is 50 x 300 ft. and contains four patenting furnaces. One of these is 30 ft. long and has a 30-in. hearth, while the other three are 50 ft. in length and have 48-in. hearths. All are about 6 ft. in height. These furnaces were designed and built by the Surface Combustion Co. of Toledo, Ohio and afford many economies and a higher efficiency than other types performing this same work.

Ratio of Reels and Blocks to Furnaces

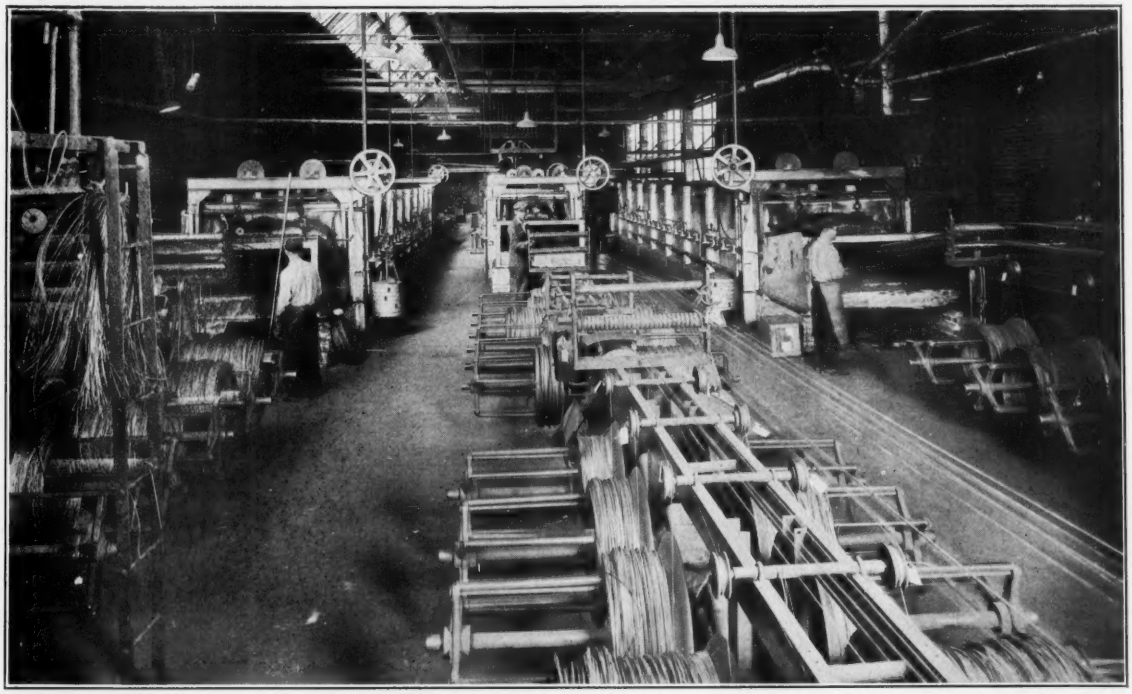
These furnaces are provided with 48, 60, 60 and 64 reels and

blocks respectively. The blocks are grouped in units of 12, each unit having a separate motor drive through variable speed gears. In this way, the heating periods can be varied to suit the grade and type of wire being treated and several kinds can be treated simultaneously.

The larger of these furnaces have 40 gas burners, 20 on each side, with an inspirator for each two burners. These inspirators exactly and automatically control the gas air ratio for any furnace atmosphere desired—oxidizing, reducing or neutral. In this case a neutral atmosphere is vital as it reduces scaling to an absolute minimum, thereby reducing the loss of material and cost of working materially.

These furnaces and blocks run the entire length of the room and were designed to give continuous and automatic operation 24 hours a day and 7 days per week. As the coils are unwound from the reels in front of the charging end, fresh coils are welded to them so there is no interruption. From the discharge end to the take-up blocks, the main wire travels through a distance of 20 ft. so that it is practically cold when it reaches the blocks.

The burners, which fire just above the hearth, are located in the last two-thirds of the furnace. The waste heat flows back toward the charging end and gives the entering wire a preheat before the heating chamber is reached. This adds materially to the efficiency of the unit. Recording pyrometers, two in number, help to maintain a temperature of from 1,750 to 1,800° F.



View of Three Patenting Furnaces, showing parts of the haul-off frames that pull the wire through the continuously-operated furnaces.

How Furnace Temperatures Are Controlled

The temperature gradient through the critical range of the grade and weight of steel being treated is controlled by varying the speed at which it is pulled through. The particular grain structure obtained is known as sorbite, which lays between the troosite and pearlite ferrite. This grain structure is obtained in all classes of work, including the aircraft material and with it is procured the required tensile strength and maximum toughness. This toughness is vital that the finished product may withstand heavy wear, abrasion, bending and torsional strains. The heating periods range from 1¼ to 5 mins. and are determined through speeds ranging from 2 to 30 ft. per minute.

These furnaces are continuous and automatic in operation and two of them will treat 1,250 lbs. in an hour. The gas consumption is 3,200 cu. ft. of manufactured gas per ton of wire. The scale loss is only 1%. The savings, as compared with the previous method of firing with producer gas, include a reduction in fuel costs of 20%, a cut in scale loss of 70% and a drop in total cost, taking into consideration labor, scale losses, power and investment of 60%.

Wire Rope Wound Onto Spools

The wire rope mill is 100x600 ft. and the first operation is that of winding the wire from coils onto bobbins or spools. As more than one coil is put onto each bobbin, the ends are brazed together with gas-oxygen torches.

(*Please turn to page 21*)

Extruded Metals in Architectural Work

Long Life and Other Advantages Resident in Extrusion Process---Influence of Chemical Composition on Color

By H. E. Huff

American Brass Co., Kenosha, Wis. *

CONCERNING the progress of Anaconda extruded architectural bronze. When invited to appear before you, my first idea was to describe the various manufacturing processes of extrusion but in searching the archives for information, I found that on two previous occasions a similar address has been delivered before your convention. Only last year W. H. Bassett, our chief metallurgist, very ably described how extruded metal is manufactured. I propose to talk to you as a salesman to a client, about troublesome matters which are constantly arising in the industry.

Not Wholly a New Process

About 30 years ago we purchased the patent right to make metals by the extrusion process in the United States. In our endeavors to develop an outlet for this material in the architectural field, we met stubborn resistance from the architects and ornamental bronze fabricators. Perhaps this was justified, but we are more likely to believe that the reason for the opposition was because we were presenting to our clients samples of the metal in its natural state, which is covered with a yellow oxide. If we had prepared finished specimens showing the splendid effects which could be obtained, we would probably have overcome the resistance more quickly. At that time we had not given sufficient consideration to the matter of castings, sheet metal and tubes, to bring about a complete harmony of color throughout an entire bronze installation. Approximately 20 years ago the most notable progress was made, with the erection of the New York Public Library in which a large volume of extruded metal was used, and it has given entire satisfaction throughout the years. From that beginning, more installations were made, and during the past 5 or 6 years, millions of pounds of extruded metal have been used for architectural purposes. All of this has not been accomplished without some trouble.

In the July issue of the Ornamental Iron and Bronze Wire Bulletin, the editor stated that a member had inquired for the best method to finish bronze work so that it would be permanent. I do not know whether this question was asked to test the ability of your secretary, or whether the member was actually perplexed and bewildered, but your secretary very smartly turned the question back to the members for answer. Several of the replies were to the effect that there was no way in which bronze work could be kept permanently bright and clean without frequent attention. One particular answer recommended the use of sharp water to clean bronze, but no distinction was made between the method of cleaning one kind of bronze work from another. This is an exceedingly vital question in this day, when such a large volume of extruded metal is being used.

Low Copper Calls for Care in Cleaning

You have been informed at various times that extruded metal contains slightly less than 60% of copper, while cast and wrought bronzes contain varying amounts of copper from 85% to 97%. The greater the amount of copper in any metal, the more resistance it has to corrosion. Because of the low copper content of extruded metal, more care should be used in the cleaning of it. Your responsibility on an ornamental bronze installation should not cease until you have informed the owner or caretaker the proper method to be used to maintain the appearance of the work.

Some few years ago we were informed that certain architects positively would not specify or permit the use of extruded metal in any of their work. We were naturally deeply concerned and proceeded to determine the reason for such an edict. We found certain bronze installations had taken on a dull red appearance, which was not pleasing to the eye and brought complaint from the owners of the buildings. The matter was thoroughly investigated by our technical department, and we found that the caretaker was cleaning the bronze very frequently with a polish which had a heavy acid base. The liquid was being applied to the metal, allowed to dry, and the resultant grayish powder was rubbed off. In the beginning this polish gave very satisfactory results without much effort. Gradually the acid ate away particles of zinc, leaving a deposit of copper on the surface of the metal. The longer the acid cleaner is used on the metal, the deeper the copper deposit becomes, and eventually it will be very difficult to remove.

Address before Nat'l Ass'n of Ornamental Iron, Bronze and Wire Mfrs., St. Louis, Mo.

Pumice and Turpentine for Cleaning

For cleaning extruded metal, we recommend that a paste be made of powdered pumice and turpentine. After the metal has been cleaned and polished with this paste, it should be wiped with a soft cloth which is slightly dampened with a neutral mineral oil.

A few weeks ago one of my clients asked me to call at his plant to investigate some metal which he claimed was not of the proper mixture. When the metal was displayed, I found that it had on the surface a variation of colors. During my investigation I learned that the customer was dressing the metal with lemon oil. We do not recommend the use of lemon oil, as this is a vegetable compound, and there is undoubtedly in it traces of lemon juice, and the juice of lemons is detrimental to practically all non-ferrous metals.

The use of white metal for architectural work is new, but we have produced extruded nickel silver for many years for other purposes. This contains about 10% nickel. This metal is not so white as other alloys of nickel silver containing 12-20% of nickel, but several highly satisfactory installations have been made. Nickel silver as it comes to you will have a reddish brown oxide on the surface, but when this is removed and the true color is displayed the metal is grayish white.

The demand for white metal has brought several substitutes into the field, such as stainless steel, aluminum, and chromium plated moldings, but we do not believe the finish, appearance and lasting qualities of these can be compared with nickel silver. We offer tubes sheets and castings to match extruded metal.

White Metal Must Be Carefully Installed

The quality of work affects to some extent the use of our product. A few days ago I was called in conference with the superintendent of buildings for a large corporation, to assist in determining the proper white metal to use in a new building. We inspected several white metal installations. The first one was very poor. The fabricating was carelessly done; nickel plated screws were used, and in several places the plating had peeled off, leaving a bronze screw exposed. The second job was very attractive. The fabrication was well done, and the matched effect was splendid. The third job was well installed, but several different kinds of metal were used, and the various members did not match.

There has been some objection to the color of extruded nickel silver, but we cannot improve the color, because the nickel content controls the color, and we are not able to extrude material which contains more than about 10% of nickel. You can obtain drawn moldings in nickel silver ranging in nickel content from 10 to 30%.

One subject that has been a source of considerable trouble, is the welding of extruded bronze or nickel silver. There are a few fabricators who are successfully welding this metal, but the great majority are having trouble because the melting point of this material is so low that the extruded metal becomes burned and warped before the welding rod flows. A recent development I believe will overcome this difficulty. A company which specializes in fluxes and brazing rods has offered rods which are suitable for brazing extruded metals, both white metal and bronze, and if you are interested in this matter, will be glad to receive your inquiry which will be referred to the manufacturer.

Outlook for British Wire Combine Improving

Increased Sales in 1929 and Concentration in Fewer Factories

By A. C. Blackall, London

THE combine of wire and fiber rope manufacturers formed 5 years ago under the title of British Ropes, Ltd., constituted one of the earlier efforts of rationalization in British industry. Hitherto its operations have yielded rather disappointing results, but the newly issued report covering the year ended August 31 shows that the corner has been turned. The year's trading resulted in a profit of £84,880 ($424,400). In the preceding year there was a trading loss of £69,887 ($349,435). The past year's enable the debit balance of £84,152 ($420,760) brought forward to be eliminated.

The improved results are attributed by the directors to the reorganization of the business and the transfer to the controlling company of the undertakings of nearly all the subsidiary companies. Owing to the concentration of manufacture into fewer factories about one-third of the land, buildings, plant, etc., shown in the balance sheet is no longer required, and every effort is being made to realize them satisfactorily. This item stands in the balance sheet at £2,627,092 ($13,135,460).

Reginald Foster retired from the position of chairman and managing director of the combine last March. The chairman is now Colonel J. J. Gillespie, and there are three joint managing directors.

American Cable Co.'s Chicago headquarters handling sales and service on Tru-Lay wire rope and Tru-Loc fittings in the Chicago region, have been moved to the recently completed Chicago Daily News Building. The new address is Room 1765, 400 W. Madison St.

Wire Bars from Secondary Copper

Methods Followed in Recovery and Use of Waste Products—Keeping Impurities Down

By W. A. Scheuch and J. Walter Scott

Metallurgical Engineers, Hawthorne Works, Western Electric Co.

(*Continued from page 427, Dec. issue*)

THIS life is erratic and depends on care given it, that is, if kept cool during use. Mold temperature should be 250 deg. Fahr. when ready to receive copper and kept as close as possible to that temperature during casting. This means that molds should be well protected with a good wash, metal being cast should not be too hot, wire bars should be freed from molds as soon as set, bottoms of molds should rest in water and molds should be cooled back to 250° F. as quickly as possible. Given such care, our molds have an average life of 4,000 to 5,000 bars.

A suitable temperature of the molten metal for hand-casting is approximately 2060° F. At this temperature the metal will pour freely and will fill out the mold well. Colder metal will make hand-dipping very difficult because of the quick formation of a heavy skull on the ladle. Much hotter metal will cause undue consumption of both ladles and molds.

Consumption of Various Materials

The figures on consumption of some of the various materials at the refinery are as follows: The fuel-oil consumption is approximately 1,300 gal. daily, which calculates to approximately 30 gal. per ton of copper melted. Approximately 10 green poles weighing 200 lb. each are required to pole the heat of oxidized copper to the required pitch. An additional 15 smaller poles weighing 10 to 200 lb. each are required to maintain the copper at pitch during casting. This calculates to a pole consumption of approximately 100 lb. of wood per ton of copper. To maintain a blanket of charcoal on the bath during casting requires approximately 1000 lb. of northern body wood charcoal. Water for cooling the bars is used at the rate of 250 gal. per min. (125 gal. to each tank) during the casting period. Approximately 60 lb. of bone ash is required to spray the molds for casting 350 bars. From 30 to 50 ft. of ½-in. black iron pipe are used in oxidizing each charge unless the refining is prolonged to reduce the lead content, when as much as 100 ft. may be used.

In the first installment in the December issue the authors described the nature of the raw material, the handling of this in charging the furnace, furnace construction and operating details very briefly and the method of casting the bars.

Over a period of approximately three years, the material shrinkage, or the difference between gross weight of secondary copper scrap input and wire-bar output, has averaged approximately 2 per cent., over one-half of which was recovered from the slag produced.

Impurities and Their Elimination

The impurity most frequently found in the copper charges at the Hawthorne plant is lead. This is unfortunate, because lead is one of the hardest elements to remove from copper by fire-refining methods.

There seems to be some question as to the effects of lead in copper. Experimental evidence at the Hawthorne plant indicates that small amounts of lead, for example up to a maximum of 0.015 per cent., will cause no trouble during hot-rolling into wire rod or while the rod is being cold-drawn into heavy sizes of wire. Neither does it have an appreciable effect on the tensile strength or elongation of the cold-drawn wire or on the electrical conductivity of the wire after anneal. However, if copper containing between 0.005 and 0.015 per cent. lead is processed into fine-size wire—for example, smaller than No. 22 B. & S. gage— which is to receive a subsequent low-temperature anneal, it has been found that the lead has a retarding effect on the anneal. For this reason all W. E. brand copper for general release to the rod and wire mill must have a low lead content.

Maintaining this low lead content is one of the refinery's principal problems. Supervisory effort is directed definitely toward keeping it out of the raw material entering the charges but if this fails, as it does occasionally, attempts are made to remove it by fire-refining methods. If the analysis obtained on the melting-down sample shows more than 0.005 per cent. lead present, approximately 100 lb. of lime rock and 100 lb. of sand is added to the furnace after the charge has been rather thoroughly oxidized. The resulting slag is allowed to remain on the charge for at least an hour, during which time the bath is continually blown with air. Samples are taken from time to time to determine the progress of the lead removal. This method of slagging is continued until the lead has been reduced to a satisfactory content.

Lead removal is considered to be a direct function of the mix-

ing; that is effort must be made to mix the charge thoroughly while it is in the oxidized condition, so that each part of the charge can come in contact with the slag. Entirely satisfactory results are seldom attained because of the impossibility of thoroughly circulating the complete metal bath in the limited time usually available. If the lead content starts rather high, say around 0.1 per cent., it may rather readily be reduced to as low as 0.01 per cent., but to reduce 0.01 per cent. to less than 0.005 per cent. is more difficult than to accomplish the complete first-mentioned reduction. Some actual lead reductions accomplished are shown in Table 1.

Sulfur is sometimes found as an impurity in the copper. It is evidenced at the beginning of casting by "gassy" copper and the characteristic "overpoled" surface of the wire bars. The fuel oil at the refinery contains less than 0.3 per cent. sulfur but it is the opinion, as yet unconfirmed, that such cases of sulfur in the copper are due to allowing unburned fuel oil to fall on the surface of the metal bath either after or immediately before poling has commenced. Therefore care is taken to see that sufficient air is supplied to the burners to completely atomize the oil at all times, and that when closing the oil burners the oil supply is turned off before the air supply. In a case or two where the "over-poled" condition has not been very bad, the charge has been oxidized back slightly and a satisfactory quality charge of metal producted. Such a procedure is decidedly not advisable. The only safe thing to do is to oxidize the whole charge back to at least a columnar fracture button (containing approximately 3 per cent. Cu_2O) and re-pole the charge.

Lead Reductions Accomplished

Table 1.

Original Lead Content Per Cent	Reduced to Per Cent	Hours
0.015	0.003	7
0.030	0.003	9
0.041	0.005	9¾
0.059	0.012	12
0.076	0.014	12¾
0.092	0.012	15

Silver is occasionally found as an impurity. Most likely it occurs through the melting down of some high-silver copper wire which was in use as line wire before the electrolytic refineries were as numerous as they are today. No attempt is made to reduce the silver content in the Hawthorne refining furnace and such heats are not cast into wire bars for general release in our rod and wire mill.

A peculiar impurity, or possibly it should be considered a condition, is noted when melting down junked wire obtained from localities near the oceans. The weathered wire is coated with a salt which is probably copper chloride. Whatever the material is, it has no effect on the quality of the final product.

Impurities other than those mentioned are seldom present. Iron would be if it were not so easily removed during the oxidizing period, because tramp iron is present in all scrap. Antimony and arsenic may be present in small amounts but they are always less than 0.003 per cent. on the final material without taking any special steps to remove them.

Conclusions

Four years of experience have resulted in the assurance that wire bars of present commercial electrolytic quality can be made by converting secondary copper in a suitable reverberatory furnace. It is true, however, that the secondary copper must be selected carefully and impurities kept out of the final product largely through the careful control of the input. Whether or not it is economical to recover secondary copper as wire bars depends on the amount of selected scrap available, the cost of the scrap, the market for the wire bars, and the relation of the proposed location of the installation to both the source of the secondary copper and the market for the wire bars produced. It is impossible to give a general statement as to the minimum size of an installation that could be operated on an economical basis without taking into account many factors, including freight rates. A study of each individual case must be made to determine the advisability of installing such a process.

British Colliery Inaugurates Great Wire Ropeway

By A. C. Blackall, London

A METHOD of transport new to the county of Kent, Eng., was started recently when the first section of an aerial ropeway was set in motion at Pineham, a village between East Langdon and Whitfield. The whole of this wire ropeway is not yet complete. The section between Pineham and Tilmanstone Colliery has been constructed, while the other section, which continues the ropeway to the eastern arm of Dover Harbor, will be finished by the end of December, and the colliery anticipates that it will be able to ship coal via the ropeway from Dover at the beginning of the New Year.

It would occupy about 24 hours to send coal by rail from the colliery to Dover Harbor, yet the distance is only a few miles. From the colliery sidings the cars would have to be sent to Shepherdswell by the East Kent Light Railway, and if they were consigned to the Dover Dockyard, lying to the east of the town, they would have to pass along the whole length of the Dover seafront. Probably, however, time was not the deciding factor. The cost of transporting a ton of coal between these two points was the main consideration, for, unless this could be done at an economic figure, the outlook for the future prosperity of the colliery would have been black indeed. Litigation, however, was necessary before the ropeway was sanctioned; in fact, the law casts to secure the

(*Continued on page 23*)

Weaving Fourdrinier Wire

Wire Sizes and Methods of Handling---Selvage and Artificial Selvage---Insertion in Machines

By Clarence Beebe

WEAVING wire cloth for the use in paper manufacturing requires the utmost care from the moment of drawing the wire of the required guage to the final act of stretching on the table before rolling up and packing for shipment.

These wires, of either brass or bronze, are delivered to the weaver in bundles in long billets. They are heated and rolled down to ¼-in. rods. These are annealed, drawn down further and then annealed again. The drawing is done through diamond dies and continued till the wire is drawn to the required guage of .006-.021 in., when it is annealed again and cleaned. This repeated annealing retains all possible life in the wire. The warp and shute of the cloth requires different degrees of annealing. The warp wire is medium hard and the shute wire is softer. The wire intended for the warp is now unwound from the annealed coils on to spools. The mesh of the wire in process determines the number spools for the warp, say 60 spools for a 60-mesh wire, the wire generally used on the machine for ordinary print paper. A beam at the rear of the loom receives the wire as it is unwound from the spools, locating in grooves in the surface of the beam.

Loading the Weaving Heddles

These wires are then threaded singly into eyelets in the heddle. These heddles are hung on two parallel frames, one wire going into the front frame and the next wire into the rear frame, and so on alternatingly. Wires are then threaded through a reed made of fine steel 2¾ in. long by ¼ in. wide. In the process of weaving the shuttle carrying the shute wires is projected through the space made by the raising and lowering of the heddles holding the warp wires. For many years hand looms were used and two operators were necessary at a loom to throw the shuttle back and forth, but the demand for greater widths of wires required a change so that automatic power looms are now in general use. It will be seen that the re-dressing of a loom for a new wire consumes a week or more of time. A wire mill with 50 looms will have at least 10 of them idle before they are in condition to weave.

In an earlier article by Mr. Beebe, well and widely-known paper wire expert, his name was erroneously given as William.

Loop Formation of Selvage

The selvages at the sides of the wire cloth present an important local characteristic, which demands care and attention. These selvages are formed in loops from the shuttle as it travels back and forth between the warp wires. The softness of these shute wires, being generally of brass, offers a pliable quality to the bending loops. There is no tension in the shute wire, they act simply as a filler.

In fast-running machines there is apt to be an unusual pressure against the selvage, causing a slight dent, which grows in depth unless prevented by the parallel lines of silks which have been woven in the warp. A slight trimming of the selvage will lengthen the life of the wire appreciably.

An artificial selvage has been created when a wide wire has been woven and then cut through its center forming two wires. This may be economical but it is not recommended. When the completely woven cloth is ready to be sewn so as to be made an endless wire, it is taken to the sewing table; here the ends of the fabric are brought together and sewn with a bronze thread. A short small rod is used around which the sewer passes the thread, up two meshes and over one mesh, giving a diagonal thrust to the thread. Stronger seams can be made for heavy papers. The tension on the warp wires will develop the weakest part of a wire and that point is generally just back of the seam. A seam is sometimes reinforced with solder, at the ends of the warp wires, care being taken not to fill up the meshes as this would affect the suction and leave a mark on the manufactured paper.

Prospects for an Inventor

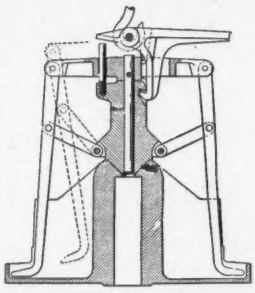
In the future some inventive genius will conceive the possibility of weaving this metal cloth in a continuous seamless fabric, of the required length, but there are a few mills where the fourdrinier part of the machine is not adapted to taking on a sewed wire. In these cases the unsewn wire is placed on the machine and the sewing operators ply their thread while sitting on top of the machine.

Below will be found a memorandum of the gauge of wires used by Paper Manufacturers:

Mesh	Warp	Shute	Inch
56x40	0.24 mm	0.24 mm	.0094x.0094
60x44	0.22 mm	0.22 mm	.0086x.0086
64x48	0.20 mm	0.21 mm	.0078x.0082
70x56	0.18 mm	0.18 mm	.0070x.0070
74x60	0.17 mm	0.17 mm	.0066x.0066
78x64	0.16 mm	0.165 mm	.0062x.0064

Diamond Chain & Mfg. Co., 417 Kentucky Avenue, Indianapolis, is completing an addition to its plant providing 40,000 feet of floor space, most of which is devoted to offices and administration quarters.

A REVIEW *of* RECENT PATENTS



Complete descriptions and drawings of any of the patents referred to on this page may be had for twenty five cents. Address orders to Wire & Wire Products, 551 Fifth Avenue, N. Y. C.

At left, Bittman Stripper, 1,734,360
At right, Martindell Coating Process, 1,734,737

No. 1,734,360, WIRE-BLOCK-STRIPPING MECHANISM. Patented November 5, 1929 by Jesse C. Bitman of Cuyahoga Falls, Ohio, assignor to The Vaughn Machinery Co., Cuyahoga Falls, O., a Corporation of Ohio.

This device includes a spider, the ends of the arms of which engage the end of the bundle of wire.

No. 1,734,704, METHOD OF AND APPARATUS FOR UNWINDING STRAND MATERIAL. Patented November 5, 1929 by Thornton McDuffey Yancey of Oak Park, Illinois, assignor to Western Electric Company, Incorporated of New York, New York, a Corporation of New York.

One embodiment of the invention consists in the withdrawal of strand from a rotatable supply within a serving head into covering relation with respect to a vertically movable wire positioned coaxially therewith. The strand passes from the supply around a friction member rotatable in response to the rotation of the serving head and is then associated with the supply in such a manner that the total force required to rotate the supply in withdrawing the strand therefrom will be distributed between several portions of the withdrawn strand.

No. 1,734,705, METHOD OF AND APPARATUS FOR UNWINDING STRAND MATERIAL. Patented November 5, 1929 by Thornton McDuffey Yancey, Oak Park, Ill., assignor to Western Electric Co., Inc., of New York, N. Y., a Corporation of New York.

The invention contemplates the withdrawal of strands from rotatable supplies revoluble about the axis of an advancing cable. Strands withdrawn from each supply engage a stationary friction member and are then redirected into association with their respective supplies so as to distribute the total force required to rotate the supplies during the withdrawal of strands therefrom between a plurality of portions of each strand.

No. 1,734,737, METHOD OF AND APPARATUS FOR COATING STRAND MATERIAL. Patented November 5, 1929 by Frank Martindell, Riverside, Ill., assignor to Western Electric Co., of New York, N. Y., a corporation of New York.

This method consists in longitudinally drawing the wire through a bath of a coating substance, and revolving the material in a direction transverse to the direction in which it is drawn and after the material has emerged from the coating bath to remove an amount of the coating substance.

No. 1,734,745, APPARATUS FOR REMOVING INSULATION. Patented November 5, 1929 by William Harry Ray, Chicago, Ill., assignor to Western Electric Co., Inc., of New York, N. Y., a corporation of New York.

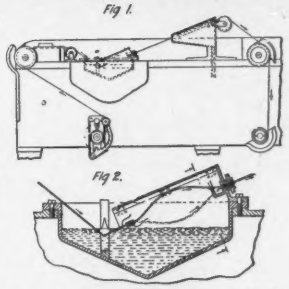
An apparatus embodying the features of the invention comprises adjustable means for supporting the cable and the conductors formed therefrom and means for separating and straightening the conductors before the stripping operation. Electrically heated elements are provided for charring the insulation which is to be removed from the conductors, and a plurality of rotating wire brushes are provided for thereafter removing the charred textile insulation and the enamel coating from the conductors. A pair of rolls which are normally in contact with a liquid cement are adapted to be moved in contact with the conductors, whereby the ends of the insulations remaining on the conductors are cemented in order to prevent fraying. A pair of cooperating knives are provided for cutting the ends of the conductors uniformly after the skinning operation.

No. 1,734,900, LEADING-IN WIRE FOR GLASS VESSELS. Patented November 5, 1929 by Ernst Friederich, Berlin, Germany, assignor by mesne assignments to General Electric Co., a Corporation of New York.

This wire consists of an alloy having substantially the same coefficient of expansion as lead glass, the alloy consisting of about 80% iron, about 10% cobalt and about 10% molybdenum.

No. 1,735,580, WIRE WORKING MACHINE. Patented November 12, 1929 by Frank Magidson, Pittsburgh, Pa., assignor to Star-Service Hanger Co., Detroit, Michigan.

The main object of this invention is to provide in a wire working machine an improved means for twisting the ends of an article, such as a garment hanger, together. This is a division of the patentee's application filed August 5, 1926, Serial No. 127,317.



No. 1,735,640, METHOD OF MAKING ENDLESS WIRE FABRICS. Patented November 12, 1929 by Rene Franck, Selestat, France.

To do away with seams and the like, in the manufacture of wire cloth, the inventor provides the process of using metallic end weft-wires having different fusing points, inserting them side by side between the end warp-wires, bringing the ends of the fabric together, and then applying heat to cause the metallic end weft-wires of lower fusing point to join together the end warp and weft-wires of higher fusing point.

This invention relates to improvements in wire fabric which is particularly designed for use as conveyor belts, aprons, screens and the like. The wire fabric is formed of wires, twisted into spiral shape, some of the spirals being right-hand ones and others left-hand ones, the right-hand spirals being alternately arranged with respect to the left-hand spirals, and staple-shaped wires connecting the spirals together, one limb of each staple passing thru the vertices of each pair of right-hand spirals, and the other limb of each staple passing through the vertices of each pair of left-hand spirals.

No. 1,735,846, WIRE-DRAWING APPARATUS. Patented November 19, 1929 by Harold Langley Blood, Oak Park, Ill., assignor to Western Electric Co., Inc., of New York, N. Y., a Corporation of New York.

More particularly, this invention relates to the mounting of dies in wire drawing apparatus. The invention includes a shelf or holder resting on ball bearings and which is adapted to support a plurality of drawing dies. A circular motion is imparted to the shelf by an eccentric arrangement, which causes the wire as it is drawn through the supported dies by a suitable capstan to travel backward and forward across the face of each step of a stepped capstan.

Sleeper & Hartley TRADEMARK

Practical Wire Wo

These Machines Go Into Production at nce-

Continuous Rod Frame

(No. 5—14 or 15 wire)

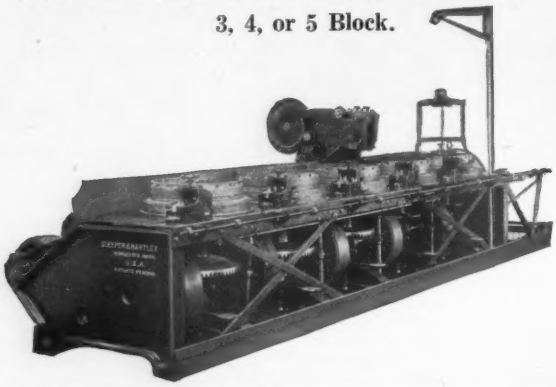
Patented June 3, 1924—May 12, 1925—others pending

All Ball or Roller Bearings

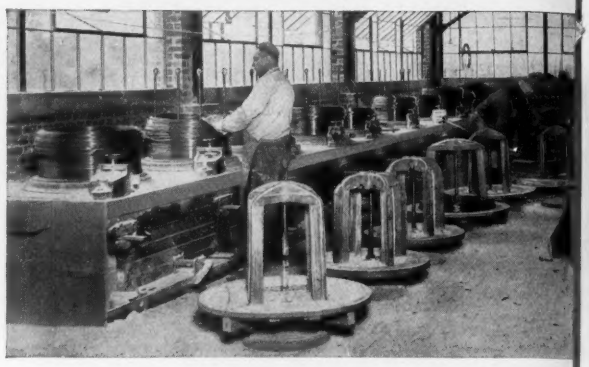
No Differential Gearing.

Automatic Compensation for Speeds of Heads.

3, 4, or 5 Block.



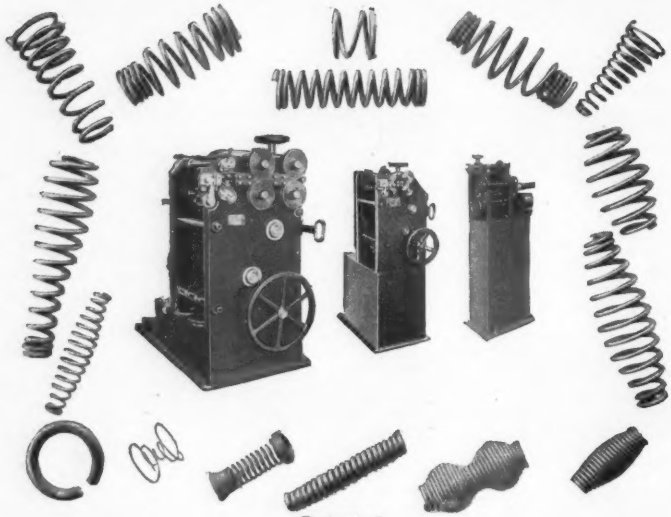
Single Hole Drawing



Standard Rod Frame—10 Block

Long, Stiff Spindles, in anti-friction bearings, and equipped with friction Clutches. Powerful and reliable. Practically noiseless in operation.

(New Plant of Thompson Wire Co., Worcester, Mass.)



Patented

Spring Coiling Machinery

of every description

For example, we offer:

Universal Spring Coiling Machines

in ELEVEN Sizes

handling oil-tempered wire from .004" to ⅝" diam. These machines produce spring forms as illustrated herewith at very high productive speeds.

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Los Angeles:
L. G. Henes Machinery Co.

FOREIGN AGENTS AND REPRESENTATIVES: UNITED KINGDOM—Mr. Fredk. A. Perry, 63 Queen Victoria St., London, E. C. 4
AUSTRALIA AND NEW ZEALAND—Edwin Wood Pty. Ltd., Melbourne
MONTREAL AND TORONTO—Arthur Jackson Machine Tool Co.
JAPAN—Andrews & George Co., Tokyo

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orking Machinery

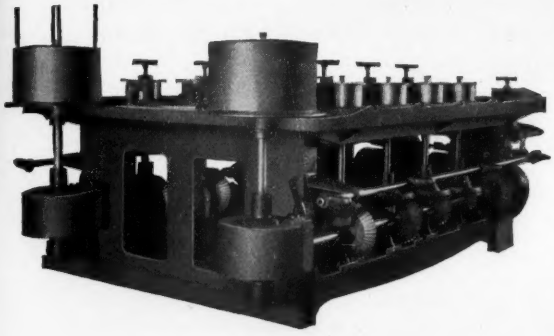
Sleeper & Hartley TRADE MARK

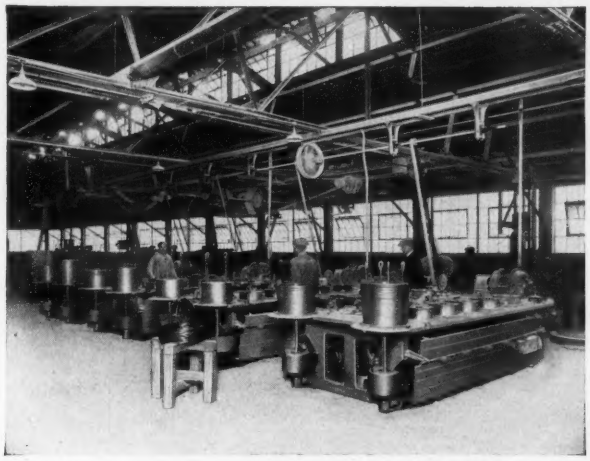
REG. U.S. PAT. OFF. & PRINCIPAL FOREIGN COUNTRIES

at nce—Reducing Overhead—Increasing Production!!

Double 5-Draft Dry, Intermediate

No. 14 to No. 23. High or low carbon wire.
3 to 4 Blocks to Average Operator.
No. 14 to 19—4 hole, 1400 lbs. per block.
No. 14 to 20—5 hole, 1100 lbs. per block.
More than 300 heads of this improved model in operation





Battery of Double Six-Draft Dry Continuous For High Carbon Wire
Direct driven with silent chain. Cut gears throughout. Anti-friction bearings. Variable speed for finishing block. (New Plant of Thompson Wire Co., Worcester, Mass.)

We have now acquired from Mr. R. E. Strand THE EXCLUSIVE RIGHTS for the Manufacture and Sale of

Te STRAND WIRE ENAMELLING MCHY.

and can offer early delivery on the

No. 1 Fine Wire Machine

Allquiries for this equipment should be addressed directly to our Worcester Office.

NEW YORK TERRITORY—Triplex Machine Tool Co.

Philadelphia Territory
Swind Machinery Co.

t ARTLEY, Inc., WORCESTER, MASS., U. S. A.

NEWS *of the* INDUSTRY

Foreign Trade Opportunities reported by the U. S. Bureau of Foreign and Domestic Commerce during the month of December include inquiries from the following sources: Bare copper wire (42210) Wellington, New Zealand; wire netting (42,-248) Buenos Aires, Argentina; wire rope (42247) Amsterdam, Netherlands; wire-nail machinery (42259) Sao Paulo, Brazil; copper wire (42198) Bratislava, Czechoslovakia; bolts, screws, rivets, (42407) Montevido, Uruguay; barbed and plain wire (42487) Bogota, Colombia; heat treating and hardening equipment for springs (42439) Turin, Italy; barbed wire manufacturing machinery (42450) Melbourne, Australia; automobile springs (42499) Tegucagalpa, Honduras; resistance and asbestos-insulated wire (42513) Melbourne, Australia; iron and steel rolls for steel works (42,-553) Glasgow, Scotland; screen wire cloth by the carload (42,-622) Winnipeg, Canada; phonograph needles (42507) Rio de Janeiro, Brazil; insulated wire and cables (42792) Casablanca, Morocco; welding wire, best grade (42850) Cardiff, Wales.

Electrification of Southern Railway, London

The directors of the Southern Railway Co. headquarters London, have decided to start work this winter on the electrification of 37 miles on the main line from London to Brighton, and also on 20 miles from Redhill to Guildford and 11 miles from Preston Park to Hove and Worthing. Estimated expenditure £2,000,000.

Krupp Grants 24 Nirosta Licenses

Alhough the Friedrich Krupp plant is the sole German holder of patents on high-chromium nickel steel, the company is not seeking to monopolize the production of this alloy, and has licensed 24 makers in Germany to operate under the patents for Nirosta. The charge for licenses is not high, but the number of licensed makers makes a substantial total income from this source. A policy of licensing other makers was adopted by the Friedrich Krupp A. G. as the best means of avoiding possible severe competition from companies that otherwise might have developed a competitive product to which the patents might not have applied.

Konel, a Substitute for Platinum

"Konel" is the name applied to a new metal which is being used extensively as a substitute for platinum wire in the manufacture of filaments for radio tubes. It is credited with being much stronger than other metals at high temperatures and can be used in the moving parts of internal-combustion engines and other extremely hot places. Originally it was developed as a platinum substitute, but was found to be harder to forge than high-speed steel, and to be very tough at high temperatures, when most metals lose their strength. Engineers believe the metal will be useful in making valves, valve stems and turbine blades. As a substitute for platinum, they estimate the metal represents a saving of $250,000 a month, because platinum costs $180 an ounce while konel costs $15 a pound. Tubes equipped with konel filaments may be operated 175 degrees colder than those with platinum fixtures. Konel is also resistant to most acids.

New York Plant to Make Wire Ties

The Bates Valve Bag Corp., Oswego, N. Y., the machine division of the St. Regis Paper Co., has started the manufacture of wire ties. A force of 40 skilled mechanics are busily engaged in the plant and on 18 machines making wire ties, used for fastening flour and other sacks and for binding concrete materials together. One half of the machines used in the process are still operating in the Chicago plant but these will be dismantled and shipped to Oswego as soon as the Oswego machines have been placed in operation. The company will also manufacture a number of other products including machines of an automatic type for filling bags with cement, plaster and other materials of similar nature, and the bag making machines such as are used in the plant of the Taggart Paper and Bag Co., Oswego.

Personal Mention

F. M. Hesse has been appointed secretary of the National Steel Corp., formed by the merger of Weirton Steel Co., Weirton, W. Va., Great Lakes Steel Corp., and the blast furnace subsidiaries of the M. A. Hanna Co. He was born in New Cumberland, W. Va., and educated in public schools of Pittsburgh and at Bethany College. He has been with the Weirton Co., since 1912.

Myron C. Taylor, chairman of the United States Steel Corp., **Cornelius F. Kelley,** president of the Anaconda Cooper Mining Co., and **Walter S. Gifford,** president of the American Telephone & Telegraph Co., well known in the wire industry, are members of the twenty leading business men, directing corporations, named by Julius H. Barnes, chairman of the Chamber of Commerce of the United States, as the executive committee authorized by the recent national

business survey conference to recommend courses of action looking to the business stabilization.

Obituary Notices

Jesse Atherton, manufacturer of tack, nail, rivet and wire forming machinery at 24 Calender St., Providence, R. I., for a number of years, passed away late in October. The business is being closed out.

Stewart Hartshorn, Jr., son of the inventor of the spring roller shade, died of pneumonia in Short Hills, N. J., in December. He was vice-president of the Stewart Hartshorn Co., large user of wire, also a director of the Joanna Cotton Mills of South Carolina and the Oswego Shade Cloth Co., Oswego, N. Y.

Dr. James Harris Rogers, inventor of multiplex telegraph printing machines and pioneer in underground and underwater radio communication, died suddenly at Hyattsville, Md., of heart disease at the age of 79 on Dec. 12.

J. C. Waterbury, president, Waterbury Co., New York, manufacturer of wire rope, died from a fall from a train at Weehawken, N. J., Dec. 20, aged 49 years.

Elliott J. Brown, for the past 25 years chief engineer at the Washburn Wire Co., Philipsdale, R. I., died suddenly on Dec. 17. He was born at Mapleton, Pa., in 1871. Leaving Juniata College before he was graduated, he studied engineering and later was chief engineer at plants located at Altoona, Pa., and New Haven, Conn.

Timms Spring Co., Buckeye Street, Elyria, O., manufacturer of wire springs and other wire specialties, is considering rebuilding part of plant destroyed by fire.

COMING EVENTS

January 4. Philadelphia Section, Amer. Iron and Steel Electrical Engineers, at Philadelphia, Pa.

January 10, 1930. Ontario Chapter of the American Society for Steel Treating, Hamilton, Ontario.

January 15. Chicago Section, Amer. Iron and Steel Electrical Engineers, at Electric Power Club, Chicago.

January 16. Pittsburgh Section, Amer. Iron and Steel Electrical Engineers, at Wm. Penn Hotel, Pittsburgh.

January 27-31. Amer. Institute of Electrical Engineers, at New York.

February 7. Youngstown District, Amer. Iron and Steel Electrical Engineers, at Youngstown, Ohio.

February 7. Ontario Chapter of the American Society for Steel Treating, Toronto, Ontario.

February 14-15 — Semi-annual meeting of the American Society for Steel Treating at New York, N. Y.

May 29-31—57th Annual Meeting of the American Electrochemical Society at St. Louis, Mo.

Oakite Products Inc., held the meeting of all district managers and representatives in New York late in November on the occasion of the 21st Annual Sales Conference. Every section of the United States and Canada was represented and the daily discussions covered every conceivable kind of cleaning work. The technical papers were augmented by special laboratory demonstrations and the part of the Technical and Laboratory Staff and those men who had made certain fields their special study.

Kelly Wire Die Corp., 4 West 22nd St., New York, formed to manufacture composition metal alloy dies for wire drawing.

Belfont Steel & Wire Co., Ironton, O. has been petitioned into receivers' hands. D. T. Croxton, Cleveland-Cliff Iron Co., member of the Creditors' Committee, and I. P. Balnton, president of the Belfont Steel & Wire Co., have been appointed receivers. Since 1927 the company has been controlled and managed by the Creditors' Committee and in a report to the Court this committee justifies the belief that with uninterrupted operation its assets will be more than enough to meet all indebtedness. The Belfont is one of the oldest steel concerns in the Cincinnati district and was established in 1864. In 1923 the company absorbed the Kelly Nail & Iron Co., Ironton, O.

Stanley Works, New Britain, Conn. will pay a stock dividend of 25% increasing the capital stock from $10,400,000 to $13,000,000. The last financial statement of the consolidated companies showed a total surplus of $10,388,784 and assets of $27,314,970.

The Union Drawn Steel Co., Hartford division, was recently awarded a silver loving cup emblematic of the best no-lost-time accident record in the entire organization. The record of 445 days without loss of time due to accidents is outstanding in the cold drawn steel industry.

Lake Erie Nut & Bolt Co., and Lamson & Sessions have agreed to merge. J. G. Jennings was elected chairman, George S. Case, president and N. J. Clarke, former president of the Lake Erie Co., vice-president and chairman, executive committee.

Philadelphia Ins. Wire Co., has declared an extra $1 and regular semi-annual of $2.50.

American Screw Co., has declared extra dividend of $1.25 and regular quarterly of $1.50.

Barton Steel Co., 3426 So. Kedzie St., Chicago, rolling mills producing reinforcing bars has been sold to Scott-Weiss Steel Co., 110 South Dearborn St., broker in iron and steel products and equipment. The plant consists of four acres of ground, a rolling mill, a one-story structure 98x600 ft., warehouse 100x400 ft., and combination office and warehouse.

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That More Than

DOUBLES

The Life Of The

WOODEN CABLE

REEL HEAD

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DEVELOPMENT

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1714 Sheffield Avenue
Chicago, U. S. A.

Manufacturers of

"RED HEAD"
SHIPPING REELS MACHINE

for the Wire & Cable Industry

Domestic Exports and Imports of Wire and Wire Products

Exports of iron and steel wire and wire products from the United States in September and October, 1929
(In gross tons)

Item	October 1929	September 1929	October 1928	January through October 1929	January through October 1928
Wire rods	2,578	2,247	3,425	36,676	32,536
Plain wire	3,471	3,347	4,380	39,540	39,239
Barbed wire and woven wire fencing	5,673	5,548	7,397	56,605	61,488
Wire cloth and screening	115	156	107	1,456	1,508
Wire rope	597	437	445	6,268	4,296
Insulated wire and cable	51	113	68	853	491
Other wire and manufactures of	619	625	1,451	9,255	8,182
Wire nails	721	813	968	11,477	12,696
Nails other than wire	525	778	841	8,092	7,583
Tacks	52	60	45	577	612
Bolts, nuts, rivets, except track	1,267	1,483	1,117	13,698	10,833

Imports

Imports of iron and steel wire and wire products into the United States
(In gross tons)

Item	October 1929	September 1929	October 1928	January through October 1929	January through October 1928
Wire rods	642	1,401	948	13,250	13,078
Barbed wire	450	217	572	4,936	3,693
Round iron and steel wire	88	551	606	4,717	3,836
Steel telegraph and telephone wire	....	11	5	14	173
Flat wire and strip steel	49	199	222	1,712	2,002
Wire rope and strand	379	93	117	2,158	1,372
Other wire	3	17	50	405	501
Nails, tacks and staples	609	857	1,089	7,799	8,211
Bolts, nuts, rivets and washers	34	47	46	308	222

Preliminary figures for U. S. electrical wire and wire product exports
(In dollars)

Article	October		10 months ended Oct. 31	
	1928	1929	1928	1929
Insulated wire and cable, iron or steel	$ 19,871	$ 22,703	$ 174,666	$ 321,893
Copper, bare wire	326,123	193,464	2,222,896	2,921,339
Copper, insulated wire and cable	438,273	470,552	4,041,557	5,222,912
Insulating material	162,510	132,158	1,125,317	1,235,523
Other wiring supplies and line material	106,713	123,473	828,199	1,178,402

IMPORTS of card clothing rose to 22,783 square feet, valued at $37,549, of which 19,871 square feet ($31,884) came from the United Kingdom, 1,547 square feet ($3,550) from Belgium, and 1,302 square feet ($1,965) from Germany. Receipts of wire cloth and screening dropped to 53,438 square feet from 232,368 square feet in September. France is credited with 40,620 square feet of this total, Canada with 8,516 square feet, the United Kingdom with 2,572 square feet, and Czechoslovakia with 1,630 square feet.

France was the principal factor in the heddle trade, with 2,975,000 pieces out of the total imports of 7,909,000. Other large suppliers were Switzerland (2,500,000 pieces), Germany (838,000 pieces), and Belgium (802,000 pieces). Wood-screw imports in October amounted to only 17,644 gross (valued at $1,321) of which 15,258 gross ($1,085) were received from Sweden and 1,820 gross ($153) from the United Kingdom.

The Jeschke Wire Specialty Co., Crawfordsville, Ind., has recently received an order for a million wire clips to be used by a Paris (France) perfume company around the necks of perfume bottles.

How Airplane Tie Rods Are Made

(*Continued from page 9*)

The bobbins are placed in long rows in the stranding machines, with revolving, upright rings in front of each, all driven from a single shaft. The wires pass from the bobbins through holes near the periphery of the rings which, by their revolving motion, impart the proper lay. The wires are led to a common die plate at the discharge end of the machine where all converge and are formed as they pass through.

In making up cables, usually six strands are used while the most common numbers of wires for these strands are 7, 19 and 37. In making up a 6x7 cable for instance, six equal lengths of seven-wire strands are placed in a closing machine. This is of the planetary type and consists of three upright revolving steel rings with bobbins between.

These rings are mounted on a hollow shaft through which runs a hemp core. The bobbins are revolved through a planetary motion feeding the strands through a die plate into the forming die and around the hemp core. Cables with wire rope centers are also made. The finished cables or ropes are wound on to wooden reels ready for shipment. The hemp centers are impregnated with grease which acts as a preservative for the hemp and as a grease reservoir for lubricating the rope from the inside.

This company makes its own special machinery and maintains a modern and fully-equipped machine shop for this purpose. A smaller machine shop is maintained for the making of dies, jigs, tools, etc. and several small surface Combustion furnaces are used for hardening. Chemical, physical and microscopic laboratories are included for tests. All of the aircraft material is cadmium-plated by the electrolytic method as this gives a bright silvery finish and the hardest surface known.

"BALLOFFET"

Accurate Dependable

"The quality die"

Our experts will solve your die problems

Balloffet Diamond Wire Dies Co., Inc.

144 Orange St. Newark, N. J.

Lagnieu (France) Trevoux (France)

VIANNEY

Famous Wire Drawing Diamond Dies

Vianney Wire Die Works wish the readers of Wire & Wire Products a Merry Christmas and a Happy and Prosperous New Year.

VIANNEY

Famous Wire Drawing Diamond Dies

100 5th Ave., New York

Metal Spools for Wire Drawing

Metal Spools for Annealing

Metal Bound Spools for Shipping

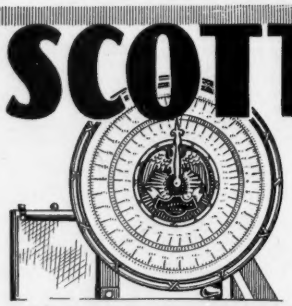
Metal Bound Reels for Shipping

Hubbard Spool Co.

1620-32 Carroll Avenue

Chicago

SCOTT



HORIZONTAL & VERTICAL TESTING MACHINES FOR WIRE

Give visible reading and graphic charts showing strength, stretch, elongation and action under stress. Used to establish standards governing purchasing and manufacturing.

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PROVIDENCE, R.I.

TESTERS

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the ideal heating medium

Modern Annealing Costs Less

LAVITE, the modern annealing process, produces better structures and better working metal. Used with the new Lavite electric furnace it gives a combination that is without equal in performance, economy and uniformity of product. Tell us what your annealing job is and we will suggest the best equipment for your work.

THE BELLIS HEAT TREATING CO.

BRANFORD, CONN.

Complete descriptive material of Lavite and Electric Furnaces is yours on request.

WIRE ANNEALING

You will be surprised at the results produced on your samples with Lavite Annealing.

AMERICAN PRESSED STEEL REELS

PRACTICALLY INDESTRUCTIBLE
STANDARD TYPES 2½ IN. TO 8 FT.
SPECIAL TYPES MADE TO ORDER
WRITE FOR CATALOG

THE AMERICAN PULLEY CO.
PRESSED STEEL
PULLEYS HANGERS HAND TRUCKS
MISCELLANEOUS STAMPINGS
4200 Wissahickon Ave., Phila., Pa.

British Colliery Inaugurates Wire Ropeway

(*Continued from page 13*)

right to construct the ropeway (as mentioned in Wire and Wire Products at the time) amounted to nearly £20,000 ($100,000), the total cost of the undertaking being between £100,000 and £150,000 ($500,000-$750,000).

Will Transport Much Coal

Ultimately, it will be possible, by means of this great ropeway, to transport approximately 3,000 tons of coal per day into bunkers on the eastern arm of Dover Harbor and load the coal into vessels at the rate of 500 tons per hour. The two wire ropes, which are each 1¼ inches in diameter, are supported by a series of 177 steel standards, or trestles, 30 feet high, each weighing over 3½ tons, and standing, on an average, about 90 yards apart. On the eastern arm there are a number of special standards, 70 feet high. Each bucket has a capacity of ¾ ton, and at no time will there be more than two travelling between any two standards, which means a continuous "chain" of buckets, separated by a distance of 42 yards—one chain proceeding to Dover Harbor laden with coal, and the other returning to the colliery empty. The whole ropeway is steam driven. From end to end there are 15 protection bridges over roads and railroad tracks, each bridge being 200 feet wide and the longest having a span of 100 feet. These are to prevent the possibility of coal falling on passing pedestrians, vehicles, or trains. Where the ropes pass over agricultural land, ample clearance has been provided to enable loaded farm vehicles to go under safely.

R. Tilden Smith, director of the colliery, said that construction had been somewhat delayed owing to the decision to adopt a more satisfactory route from the cliff to the eastern arm, necessitating the excavation of two tunnels. This variation offered economy in working and greater security during

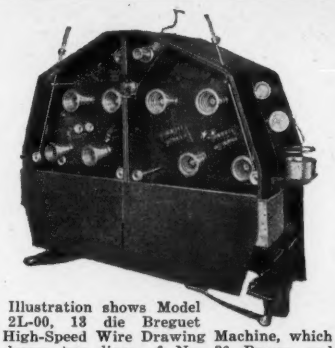
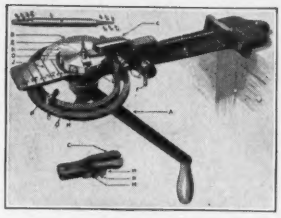


Illustration shows Model 2L-00, 13 die Breguet High-Speed Wire Drawing Machine, which draws two lines of No. 36 Brown and Sharpe Gauge and finer sizes of copper wire at a finishing speed of 4000 to 4500 feet per minute.

EST. 1855 AIMco INC. 1918
"American" INSULATING MACHINERY COMPANY
REG. U.S. PAT. OFF.
PHILADELPHIA PENNSYLVANIA U.S.A.
EXCLUSIVE AGENT FOR the United States, Canada, Mexico, Central and South America of the
BREGUET HIGH-SPEED WIRE DRAWING MACHINES
Patents Applied For in the United States. Patented in France and Great Britain.
SEND FOR CATALOG

KILMER LITTLE GIANT WIRE FORMER

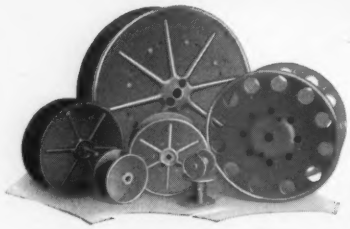
Forms Eleven Sizes of Eyes from Round, Square, Flat or Half-Round Stock, also almost any shape desired Quickly and Efficiently.
Adjustable for No. 3 to No. 24 Gage Wire.
The cut on the left shows a few of the thousands of the forms made on this FORMER
Price $50.00



Patented April 2, 1918
M. D. Kilmer & Co. Cleveland, Ohio, U. S. A. Box 1337, Station B.

STEELSKIN
REG. U. S. PAT. OFFICE
For High or Low Carbon Wire
WIRE DRAWING SOAPS
Established 22 years.
R. H. MILLER CO., Inc. Homer, N. Y.

WIRE INSULATING, STRANDING AND CABLING MACHINERY
NEW ENGLAND BUTT COMPANY
Office and Factory 304 Pearl St., Providence, R. I.
Western Office 140 So., Dearborn St., Chicago, Ill.
We build a complete line of Stranding Machines, Cabling Machines, Closing Machines, Rubber Strip Covering Machines, Measuring Machines, and Other Allied Machines for the Wire Trade.
OUR WIRE MACHINERY CATALOGUE SENT ON REQUEST



You Can't Go Wrong by Saving Money

The many firms in the wire industry which have standardized on Apco Mossberg equipment have done so for just one reason: to save money.

You can't go wrong saving money, in wire handling, manufacture, or shipping; and Apco Mossberg pressed steel reels and spools will save it for you.

They are light in weight, extremely true and long wearing.

APCO MOSSBERG CORPORATION

ATTLEBORO, MASS.

Specialists for twenty years in the development and manufacture of steel reels for annealing, vulcanizing and stranding; also bobbins for wire weaving.

Improves the grade of every run

QUALITY of wire depends in large measure upon the effectiveness of the acid dip. Make certain that acid will do its work thoroughly and quickly by cleaning wire before the dip with an Oakite material.

Oakite cleaning removes every trace of soap, film and dirt from the wire. Improves the grade of every run by affording the acid an opportunity to act on chemically clean metal. Learn more about the advantages of Oakite wire cleaning. Write for full particulars. No obligation of course.

Oakite Service Men, cleaning specialists, are located in all the leading industrial centers of the United States and Canada

Manufactured only by
OAKITE PRODUCTS, INC., 52A Thames Street, NEW YORK, N. Y.

OAKITE

TRADE MARK REG. U.S. PAT. OFF.

Industrial Cleaning Materials and Methods

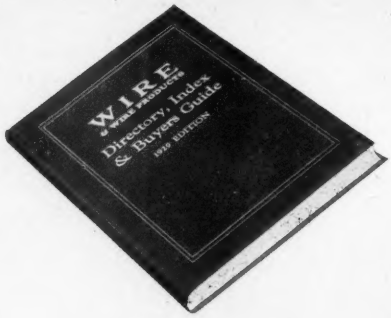
operation. He declared that the colliery's scheme of intensive development would be impossible without the ropeway, which would enable it to utilize the vast natural resources of Kent.

The starting ceremony was performed by Mrs. R. J. Barwick, wife of a former Mayor of Dover. By turning a handle she set the ropeway in motion, the first bucket arriving at the station exactly 45 minutes after leaving the colliery. In the interval Mr. Smith presented Mrs. Barwick with a souvenir of the occasion, consisting of a replica of two of the trestles, joined up with wire ropes, on which were suspended two tiny buckets, the whole model being the work of one of the colliery engineers, made in brass and silver-plated.

Cathode Rays Separate Natural and Artificial Sapphires

An extremely interesting development has been announced by the General Electric Co. Sapphires, next to diamonds in hardness, are used at the rate of millions a year as jewels for bearings in meters and other delicate electrical instruments, and to a limited extent for wire-drawing dies. Synthetic sapphires can be distinguished from the natural stones by means of the cathode ray tube. Trays of sapphires are exposed in a dark room to the rays of the tube for a few seconds. All glow or radiate colors while exposed to the rays, but when the rays are turned off, the natural stones cannot be seen, whereas the synthetic stones continue to glow. Not only is it possible by this means to sort natural from synthetic sapphires, but in most cases it is possible to determine the factory that made the synthetic stones by the different hue of the glow while the rays impinge upon them. Natural sapphires that come from different places can also be distinguished from one another.

Foster Bolt & Nut Co., 6300 West Sixty Fifth St., Chicago, is planning an addition to its factory at that address.



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WIRE

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Annual Directory, Index & Buyer's Guide?

LAST CALL!

1930 Edition Now in Preparation

Data is now being assembled for the second annual edition of the only reference work of its kind for bare and covered wire makers, fabricators of wire products, and sources of supply for wire and wire forming mill equipment.

Over eight hundred classifications, alphabetically arranged, cover everything used in the making and forming of all kinds of wire. The listings range from Abrasives to Zinc.

The book will be a convenient size for shop and office reference, printed in clear type on heavy paper and substantially bound in cloth. In every way it will represent an improvement over the current edition.

Last Call—No Charge For Listings—Last Call

To make this 1930 Directory as complete as possible, names of manufacturers and their products are being assembled now for careful revision before publication three months hence. Your name will be listed without charge or obligation under the headings you indicate.

Rates for advertising space in units of from one inch to full pages will be supplied on request. Very moderate rates are also available for Bold Face display listings in heavy type that makes the listing inescapably prominent when consulted by the reader.

You are urged to fill out this form **now** to avoid the possibility of having your name omitted from the contents of the Directory.

LISTINGS

(Specify Kinds of Wire, Wire Products, or Wire Mill Equipment)

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Wire & Wire Products,
551 Fifth Avenue, New York City.

You may list our name, without charge, in the forthcoming issue of Wire & Wire Products Directory, Index and Buyer's Guide under the headings here indicated and send us particulars about advertising rates and rates for Bold Face display listings.

Name .....

Address .....

City ..... *State* .....

KESTER FLUX-CORE SOLDER
FLUX IN POCKETS SOLDER WALL

Ready to Use

Needs only Heat

QUICK!

Quick, simplified operation—no separate fluxes, acids or pastes. Quick savings in time and money on many phases of industrial production and maintenance.

Our experimental and research department is maintained to study your individual soldering problem and adapt the correct Kester Solder most efficiently and profitably to your needs. A special solder designed especially for you may be necessary to reduce your operating and maintenance costs. This consultation service imposes no obligations. Your request will bring an immediate and authoritative analysis.

KESTER SOLDER CO.
4246 Wrightwood Av., Chicago, Ill.
Est. 1899, Form'ly Chic. Solder Co.

KESTER FLUX-CORE SOLDER

ACID-CORE ROSIN-CORE PASTE-CORE
METAL MENDER RADIO SOLDER

A. WALDECK & COMPANY
WIRE GAUGES AND
FINE STEEL WIRE DIES
7607 Broadway, Cleveland, Ohio

HOTEL MONTCLAIR

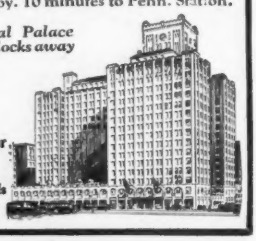
Room and Bath
Tub and Shower
$3 to $5
per day
For 2 persons
$4 to $6
per day
Suites
$8 to $12
per day
Special Monthly and Yearly Rates

49th to 50th Sts.
Lexington Ave.
NEW YORK CITY

800 Rooms
Each with Tub and Shower
Radio in Every Room

3 minutes' walk from Grand Central. Times Square, Fifth Avenue Shops important commercial centers, leading shops and theatres nearby. 10 minutes to Penn. Station.

Grand Central Palace
only 2 short blocks away



S. Gregory Taylor
President
Oscar W. Richards
Manager

Experience With Widia Metal Dies

By Morris Simons, President, Union Wire Die Corp.

EIGHTEEN months of experience with a new metal for dies has proven that high initial cost sometimes spells economy.

The use of Krupp-made Widia metal for drawing dies presented originally a serious problem because of the high cost of the metal itself, as well as the high cost of manufacturing it into dies. The users of dies seriously doubted the economy of the new product and placed orders only for small quantities of dies for experimental purposes. The manufacturer of the dies also had to be cautious in guaranteeing the dies because experience on their part was necessary to determine to what extent they could be guaranteed safely.

Experience to the present writing has developed certain definite facts from the die user's point of view. Widia alloy dies have proven their economy over chilled iron or steel dies on a basis of die cost per unit of material drawn, although chilled iron dies cost in some cases less than a 1/100th part of the cost of the equivalent Widia die. It has also been proven that the mills could afford to use these alloy dies even at a higher die cost per ton of material drawn, because of economies effected in labor costs and still more important, in greatly reduced rejection percentages. It has been determined that orders for wire, rod and tubing could be accepted safely with much closer allowable tolerances than before the advent of Widia dies. In one specialty, the drawing of calcium bronze and aluminum bronze wire, the use of a seven draft continuous machine was made possible by Widia dies, instead of the use of single blocks which were all that could be used previously.

Although marked economy has been shown on die costs in various classes of steel wire down to the .00 sizes and on copper wire in competition with diamond dies down to .057, the economy on both steel and copper and their various alloys has been most obvious on the rod sizes and in tube drawing. The reason for this condition is that the Widia dies in these cases are competing in cost with steel dies instead of chilled iron, and the ratio of cost between the Widia dies and the steel dies is much less than between the Widia dies and chilled iron. Roughly the Widia die per size costs about ten times the

The Waterbury Wire Die Co.

Diamond, Composition
and
CHILLED IRON DIES
Waterbury, Conn.

Orders-Inquiries

60 pages
Send for FREE Copy

Can be Secured by MAIL

POLK'S REFERENCE BOOK
and Mailing List Catalog

Gives counts and prices on over 8,000 different lines of business. No matter what your business, in this book you will find the number of your prospective customers listed.
Valuable information is also given as to how you can use the mails to secure orders and inquiries for your products or services.

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R. L. POLK & CO., Detroit, Mich.
Largest City Directory Publishers in the World
Mailing List Compilers—Business Statistics
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equivalent of the steel die, whereas the production per die ranges from one hundred times to several thousand times that of the steel die.

Users have found the economy of being able to draw finished sizes which, using other dies, have required grinding for finishing.

Still greater economies are being effected by mills whose use of Widia alloy dies have passed the experimental stage and which have concentrated their efforts on the proper care of the dies, thru frequent polishing, careful lubrication and prevention of rough handling.

In the earlier stages of their use the attitude of the mills had tended toward abuse of the dies in an effort to determine how well they would stand up under adverse conditions. As their investment in Widia dies has increased there has been a much greater tendency to give the dies proper care in order to obtain the best possible return from the investment. This care has been well repaid in additional production from the dies. Operators have had to be cautioned about quenching dies, about hitting them with hammers, careless dropping them; foremen and superintendents have had to acquaint themselves with the proper methods of cleaning and polishing.

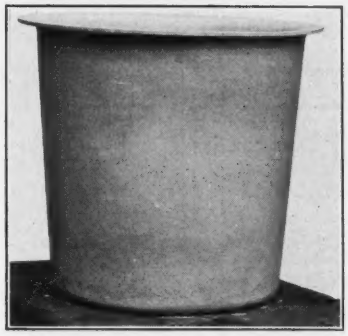
While users have been acquiring their experience, manufacturers of Widia dies also have had much to learn. Suitable machinery and methods for manufacturing the dies had to be developed and as the field for these dies gradually presented itself, special shapes and settings best suited to various special problems in drawing, were experimented with and determined upon. The shape in a hole of a chilled iron die, provided that it draws wire to size, is comparatively unimportant as against the shape in an expensive alloy die, as a slight difference in the shape of the alloy die may mean a large percentage of difference in production. Proper settings of the Widia metal inserts to

SALT ANNEALING POT

Forge Fire Hammer Welded

Fabricated of a special analysis of high grade open-hearth steel—

All seams forge fire hammer welded by our own method.



These pots furnished in any practical size or shape — In any thickness of material required.

THE SHELL OR BODY OF THE POT CAN BE FURNISHED EITHER STRAIGHT OR TAPERED AS SHOWN

Annealing Pots To Fit Your Need

COLUMBIANA BOILER COMPANY
COLUMBIANA, OHIO

"The House of Service"

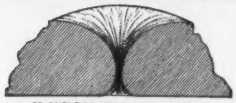
BELLET & BOUVARD

Manufacturers of

DIAMOND DIES

Factories { Trevoux / Les Abrets } France

New York Office 315 Fifth Ave.



WATCH THE SHAPE

COCHAUD

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Wire Drawing Diamond Dies

300 West 56th St., New York

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"CUT YOUR CUTTING COST"

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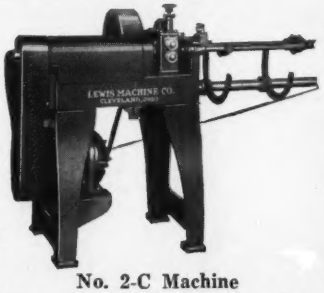
Motor Driven

WIRE STRAIGHTENING AND CUTTING MACHINES

Efficient V Belt Motor Drive, Timken Roller Bearing Equipped. Built to endure hard service. Sizes up to ½" diameter wire.



No. 2-C Machine

LEWIS MACHINE CO., 1592 E. 24th St., Cleveland, Ohio

Professional Directory

Listing in the Professional Directory is recommended to all engineers, engineering and construction firms and consultants seeking business with wire mills or plants utilizing wire in any form.

W. H. SPOWERS, JR.
Consulting Engineer
551 Fifth Ave., N. Y. C.
Specializing in Galvanizing
Plants Designed and Installed
Vanderbilt 7395 Practical Engineering Advice

This is a double-sized Professional Card

For the Business it will bring you the price of a professional card in this directory is very low.

ANNEALING SALT BATHS
FOR
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insure as far as possible against breakage under use, and under abuse, were also problems which the die manufacturer had to consider and solve for many individual specialties in drawing of wire, rod and tubing. The manufacturer also had to, with this comparatively brief experience, determine upon methods of guaranteeing their product so that die users could accept dies with full confidence.

Junior Metallurgist Wanted

The United States Civil Service Commission will receive applications for a position of Junior Metallurgist until Jan. 21, 1930. Entrance salaries range from $2,000 to $2,500 a year. The duties will consist of general metallurgical work connected with the fabrication of manufactured articles, either ferrous or nonferrous; general metallurgical work including process control, physical testing of materials or ores, microphotography and research work on a large variety of metallurgical problems. Optional subjects are (1) physical metallurgy and (2) recovery metallurgy.

Wire Rods Lower Priced in Far East

Following a considerable period of stable prices on wire rods for the Far East, keen competition among European makers has brought about a reduction as of Dec. 9, despite the fact that makers are united in a cartel. Recent quotations, c.i.f. Kobe or Yokohama, have been £7 9s. to £7 11s. per ton, (1.62c. to 1.64c. per lb.), although the official cartel price is £7 13s. 6d. to £7 15s. 6d. per ton (1.67c. to 1.69c. per lb.)

Wire Rod Cartel Quotas Raised

At the meeting of International Wire Rod Cartel, Nov. 14, in Düsseldorf prices were left unchanged for the first quarter of 1930, but, in view of an improved market, the tonnage quota was increased from 440,000 metric tons to 475,000 tons. Extension of the cartel beyond April, 1930, was discussed without apparent decision.

Telephone Wire Mileage
75,000,000

Total mileage of telephone wire in the United States on Sept. 30 was 74,310,000 miles, comparing with 67,360,000 miles the year before, an increase of about 10 per cent. Of the total amount 65.8 per cent is in underground cable 26.9 per cent in aerial cable and only 7.3 per cent in open-wire construction.

Of the total mileage in use, 10,688,000 miles are used in long-distance toll service and the remainder in local exchange service. The Bell system alone has about 67,169,000 miles of telephone wire of all kinds in use.

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European Color & Chemical Co., Weehawken, N. J.

ANNEALING POTS
Columbiana Boiler Co., Columbiana, O.

BAKERS
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

BLOCKS—Form Drawing and Shearing
J. A. Holmquist, Sharon, Pa.

CLEANING COMPOUNDS
Oakite Products, Inc., N. Y.

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Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

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Abr. Levine, New York

DIES—Chilled Iron
Waterbury Wire Die Co., Waterbury, Ct.

DIES—Diamond
Atlas Wire Die, Co., New York, N. Y.
Balloffet Diamond Wire Dies Co., Inc., N. Y. C.
Bellet & Bouvard, N. Y.
Cochaud Wire Die Co., New York.
Driver-Harris Co., Harrison, N. J.
F. Krause & Co., Inc., Jersey City, N. J.
Master Wire Die Corp., New York, N. Y.
Union Wire Die Corp., New York, N. Y.
Urdika Wire Die Co., N. Y. C.
Vianney Wire Die Works, New York.
Waterbury Wire Die Co., Waterbury, Ct.

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Cochaud Wire Die Corp., New York.
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Strong, Carlisle & Hammond, Cleveland, O.
Vaughn Machinery Co., Cuyahoga Falls, O.

GALVANIZING ENGINEER
W. H. Spowers, Jr., New York, N. Y.

GALVANIZING LADLES, PANS, POTS
Columbiana Boiler Co., Columbiana, O.

GAUGES—Wire
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LATHES—Die Reaming
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Vaughn Machinery Co., Cuyahoga Falls, O.
The Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

LUBRICANTS—Wire Drawing
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MACHINERY—Armoring (Cable, Wire, Hose)
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

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Mossberg Pressed Steel Corp., Attleboro, Mass.

MACHINERY—Bundling
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson.

MACHINERY—Cable
Watson Machine Company, Paterson, N. J.

MACHINERY—Cutting
American Insulating Mach'y Co., Phila., Pa.
Hallden Machine Co., Torrington, Conn.
Lewis Machine Co., Cleveland, O.
F. B. Shuster Co., New Haven, Conn.
Sleeper & Hartley, Worcester, Mass.

MACHINERY—Coiling
Broden Const. Co., Cleveland, O.
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M. D. Kilmer & Co., Cleveland, Ohio.

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Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Hot Coat Tumbling
J. A. Holmquist, Aliquippa, Pa.

MACHINERY—Insulating
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New England Butt Co., Providence, R. I.

MACHINERY—Measuring Wire
New England Butt. Co., Providence, R. I.
Watson Machine Company, Paterson, N. J.

MACHINERY—Nail
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Panning
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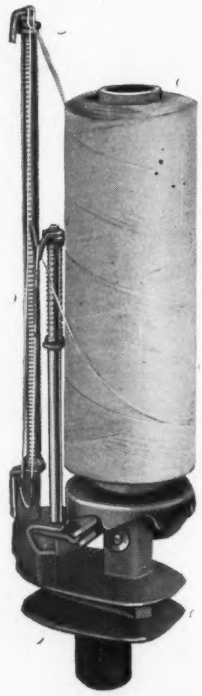

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MACHINERY—Rivet
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Vaughn Machinery Co., Cuyahoga Falls, O.
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R. B. Hayward Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

SOAPS—Wire Drawing
R. H. Miller Co., Homer, N. Y.

SOLDER
Kester Solder Co., Chicago, Ill.

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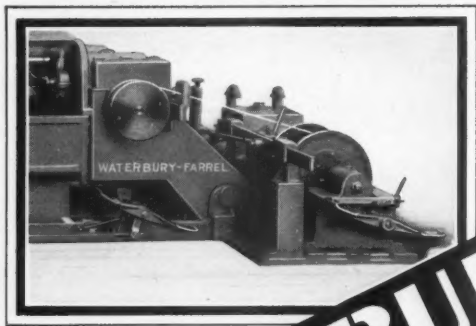

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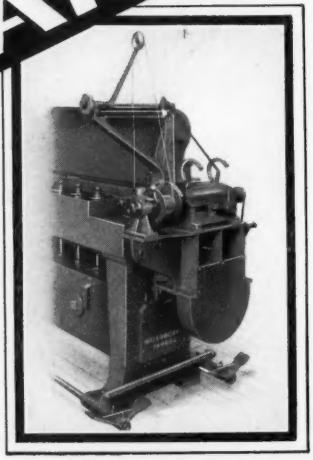

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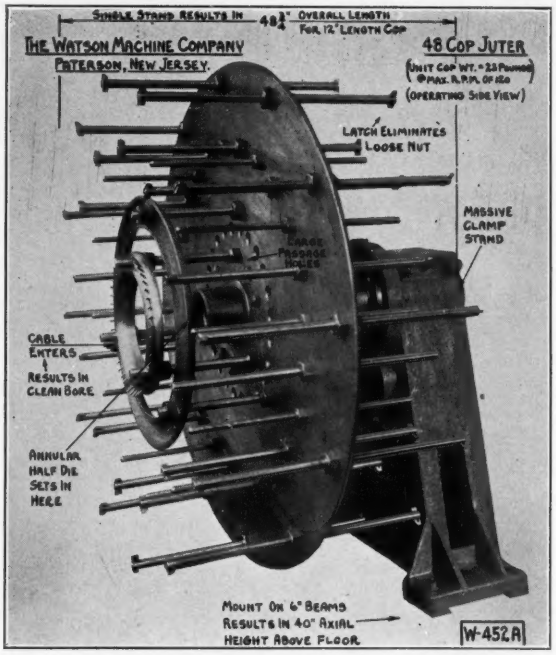
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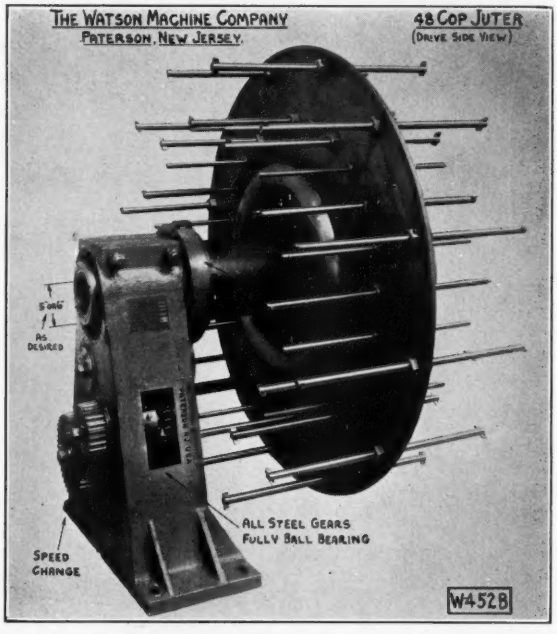

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